

A Guide to NAS-SYS

2.4.2 Changing the subroutine table.

Because the address of the start of the table is held in ram, it is possible for a user to change it so that it points to another table. This alternative table can be defined by the user. As an example, suppose an 'F' command is to be added to the list of commands, the other commands remaining unchanged. (An 'F' command in both current versions of NAS-SYS simply calls the ERM routine which writes 'Error' on the screen.)

The new F command is to simply write "F routine" on the video display, and is assembled from location FCMD. The new table begins at location NEWTAB. The program begins by copying the existing table to location NEWTAB. The address of the new F command in the new table is then changed to make it FCMD. Finally, \$STAB is changed to point to the conceptual start of the table, ie. 82H bytes before NEWTAB.

Listing of program to add an 'F' command.

ZEAP Z80 Assembler - Source Listing

```
0010 ; ADDING AN F COMMAND
0020 ;
OD00 0030 ORG OD00H
0040 ;
0050 ;NAS-SYS routine numbers
OD00 005B 0060 MRET EQU 5BH
OD00 0028 0070 PRS EQU 28H
0080 ;
0090 ;NAS-SYS workspace
OD00 OC71 0100 $STAB EQU OC71H
OD00 0782 0110 STABA EQU 0782H ;0788 FOR NS1.
OD00 OC80 0120 NEWTAB EQU OC80H
0130 ;
0140 ;Copy existing table to NEWTAB.
OD00 218207 0150 LD HL,STABA
OD03 11800C 0160 LD DE,NEWTAB
OD06 017E00 0170 LD BC,7EH
OD09 EDB0 0180 LDIR
0190 ;Change address of F command in new table.
OD0B 21190D 0200 LD HL,FCMD
OD0E 228A0C 0210 LD (NEWTAB-82H+"F+"F),HL
0220 ;Make $STAB point to NEWTAB.
OD11 21FE0B 0230 LD HL,NEWTAB-82H
OD14 22710C 0240 LD ($STAB),HL
0250 ;Return to NAS-SYS.
OD17 DF5B 0260 SCAL MRET
0270 ;
0280 ;
0290 ;New F command
OD19 EF 0300 FCMD RST PRS
OD1A 4620726F 0310 DEFN /F routine/
7574696E
65
OD23 OD00 0320 DEFB ODH,0
OD25 C9 0330 RET
```

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Assemble the above code into ram and execute from location **0C00**. Then check that an 'F' command produces the expected response. Check also that the other commands remain unchanged.

The memory used by the program is shown below. The program may be relocated elsewhere in ram simply by redefining the origin of the program and the location of NEWTAB.

0025	New F command routine.
0019(FCMD)	-----
0018	Routine to change the table.
0000	-----
	Space for new table.
0C80(NEWTAB)	-----

An F command which is more useful is listed below. Its purpose is to allow the user to change the register contents when single stepping through a program. The command description is:

FIX REGISTERS - Frs hh11
or Fs ll

The Fix command changes register r to hh, and register s to ll, where r and s are:

r/s	Register Referenced
0	none
1	I
2	IX
3	IX
4	PC, H
5	PC, L
6	SP, H
7	SP, L
8	H
9	L
A	ABCD
B	BCDE
C	BCD
D	CD
E	DE
F	EF

Thus, command FA 76 changes register A to 76H,
F45 1234 changes the PC to 1234.

Commands: EXIT, QUIT, HELP, LIST, MAX, MIN, and TELL

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register reference, are automatically changed to F02 hhll and F03 hhll respectively.

Commands F2x hhll and F3x hhll are illegal and generate an error message.

Following the F command, pressing the Enter key causes a single step from the location indicated by the PC.

The routine begins by placing the ASCII code for S into workspace location ARGX which stores the last command letter. This allows a subsequent Enter key to continue single-stepping.

NAS-SYS loads argument rs into register pair HL and argument hhll into register pair DE (see chapter 2.2). A correctly entered command should make register H zero and this is checked at line 170. Register L is then copied into register H.

At line 240 argument r is extracted from register H and checked to see if it is 2 or 3. If so subroutine ERR displays Error.

At line 350 argument s is extracted from register L and stored in register pair BC. If argument s is 2 or 3, argument r is forced to 0 by subroutine RZER. Subroutine PROC is then called to change the register.

At line 460 argument r is stored in register pair BC and argument hh moved to register E. Subroutine PROC then changes the register.

Finally, the P command is called to display the register contents.

Subroutine PROC is entered with one of the arguments r or s in register pair BC and the new data in register E. If the register number is 0, the subroutine returns without making any changes. Register numbers 1 (I), 2 (IY), and 3 (IX) are changed directly; these registers are not stored in the register save area of the workspace following a breakpoint or single step. Register numbers 4 and up are stored in the workspace (the actual locations are given in chapter 2.1, S command). These locations are accessed and modified via the table TAB which gives only the lower bytes of the addresses in the register save area, the upper byte always being 0CH.

To implement this new F command, replace the trivial code at location FCMD (0D19) in the previous program with the following code; then execute from location 0D00.

Listing of FIX REGISTERS

ZEAP Z80 Assembler - Source Listing

```

    0010 ;FIX REGISTERS
    0020 ;Frs hh11
    0030 ;Change reg r to hh, reg s to ll.
    0040 ;
OD19      0050      ORG  OD19H
          0060 ;
          0070 ;NAS-SYS routine numbers
OD19 006B  0080 ERM    EQU   6BH
OD19 0028  0090 PRS    EQU   28H
          0100 ;
          0110 ;NAS-SYS workspace
OD19 OC2B   0120 ARGX   EQU   OC2BH
          0130 ;
          0140 ;
          0150 ;For single-step
OD19 3E53   0160 FCA    LD    A,"S
OD1B 322B0C 0170           LD    (ARGX),A
          0180 ;
          0190 ;Check that H is zero, else Error.
OD1E 7C     0200           LD    A,H
OD1F B7     0210           OR    A
OD20 2803   0220           JR    Z,F1
OD22 DF6B   0230           SCAL  ERM
OD24 C9     0240           RET
OD25 65     0250 F1    LD    H,L
          0260 ;Get arg r.
OD26 CB3C   0270           SRL   H
OD28 CB3C   0280           SRL   H
OD2A CB3C   0290           SRL   H
OD2C CB3C   0300           SRL   H
          0310 ;Check for r = 2 or 3.
OD2E 7C     0320           LD    A,H
OD2F FE02   0330           CP    2
OD31 2824   0340           JR    Z,ERR
OD33 FE03   0350           CP    3
OD35 2820   0360           JR    Z,ERR
          0370 ;Get argument s.
OD37 7D     0380           LD    A,L
OD38 E60F   0390           AND   OFH
OD3A 4F     0400           LD    C,A
OD3B 0600   0410           LD    B,0
          0420 ;Check for s=2 or 3.
OD3D FE02   0430           CP    2
OD3F CC540D 0440           CALL  Z,RZER
OD42 FE03   0450           CP    3
OD44 CC540D 0460           CALL  Z,RZER
OD47 CD5A0D 0470           CALL  PROC
          0480 ;Get argument r.
OD4A 4C     0490           LD    C,H
OD4B 0600   0500           LD    B,0
OD4D 5A     0510           LD    E,D
OD4E CD5A0D 0520           CALL  PROC
          0530 ;Display registers
OD51 DF50   0540           SCAL "P
OD53 C9     0550           RET
          0560 ;
          0570 ;Force r to 0 if s=2 or 3.

```

OD54 2600	0580 RZER	LD H,0
OD56 C9	0590	RET
	0600 ;r=2 or 3 is illegal.	
OD57 DF6B	0610 ERR	SCAL ERM
OD59 C9	0620	RET
	0630 ;	
	0640 ;On entry BC holds 000r or 000s.	
	0650 ;	new byte in E,
	0660 ;	double byte in DE.
OD5A 79	0670 PROC	LD A,C
OD5B B7	0680	OR A
OD5C C8	0690	RET Z
	0700 ;Is reg no.= 1?	
OD5D FE01	0710	CP 1
OD5F 2004	0720	JR NZ,P2
OD61 7B	0730	LD A,E
OD62 ED47	0740	LD I,A
OD64 C9	0750	RET
	0760 ;Is reg no.=2?	
OD65 FE02	0770 P2	CP 2
OD67 2004	0780	JR NZ,P3
OD69 D5	0790	PUSH DE
OD6A FDE1	0800	POP IY
OD6C C9	0810	RET
	0820 ;Is reg no.=3?	
OD6D FE03	0830 P3	CP 3
OD6F 2004	0840	JR NZ,P4
OD71 D5	0850	PUSH DE
OD72 DDE1	0860	POP IX
OD74 C9	0870	RET
	0880 ;Reg no. is 4 up.	
OD75 E5	0890 P4	PUSH HL
OD76 217DOD	0900	LD HL,TAB-4
OD79 09	0910	ADD HL,BC
OD7A 7E	0920	LD A,(HL)
OD7B 6F	0930	LD L,A
OD7C 260C	0940	LD H,0CH ;HL is OCxx
OD7E 73	0950	LD (HL),E
OD7F E1	0960	POP HL
OD80 C9	0970	RET
	0980 ;	
	0990 ;	
OD81 6A696C6B	1000 TAB	DEFB 6AH,69H,6CH,6BH
OD85 66656862	1010	DEFB 66H,65H,68H,62H,61H,64H,63H,67H
	61646367	